

General Situation of Wood Resource Utilization and Processing of Recycled Fibers in China

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Abstract The general situation of the forest resources and supply of timber as well as developing survey of forest products industry in China was introduced. In front of competition of the 21st Century, the developing strategy of sustainable forestry and reasonable utilization of wood resource were formulated by China government. With fast developing of MDF(Middle Density Fiberboard), PB (Particleboard) and Chip production, the better utilization of the residues of logging lumbering and timber processing have been obtained. Meanwhile the developing situation of recycled fibers processing was described. Two kinds of recovered paper technology were analyzed and the research trend and development of recycled fibers processing were discussed.

Key words: Recycled fibers, Middle density fiberboard, Particleboard, Residues

Introduction

It is considered that wood as a resource will be placed high in 21st century and a shortage of wood will occur if the condition of the forests of the world is not improved. To make the conservation of global environment and good living of human beings, tending of forest and wise use of wood are required. These circumstances put China under an obligation to improve the today's situation that the timber production of China is in the unhealthy situation. The demand always exceed the supply and the logging amount of timber often surpass the increment of forest.

The total area of forests in China is 133.7 million hm^2 which covers 13.92% of the land area of China. The total volume of living tree is 11.785 billion m^3 . So the forest resource is not rich and forest covering is low as well as the quality of forest is not high. With the developing economy, exploring population and extending scale of cities and countryside, the demand of timber is increasing steadily and quickly. The annual growth of timber volume is estimated to be about 190 million m^3 , while the annual cut is about 200 million m^3 including the annual consume of fuelwood about 50 million m^3 . In this way the amount of wood resource in China is decreasing. In order to conserve the forest resource and develop sustainable forestry, besides extending plantation and intensive management, China is carrying out the constructions of one base and five large projects. One base is about 0.667 million hm^2 of fast growing forest. Five large projects are coastal shelter belt, Sanbei shelter belt, the ecology plantation of Taihang Mountains (in

Shanxi Province), the protective forests of water and soil conservation of the middle and down of the Yellow River, and the protective forests of water and soil conservation the of upper and middle of the Yantze River. These constructions have obtained primary success, enhancing the resistance capability of natural disaster-flood, drought, storm and sea wave etc. So far the yield of timber from artificial forests have reached 25 million m^3/year , equal to the 1/8 the total timber yield in China. Meanwhile Chinese government encourage the utilization of solar energy, wind force, natural gas, marsh gas, electricity and coal in the broad forest area, pastoral area and countryside in order to decrease the consume of fuelwood. In addition, China must import timber in a large scale (average 5 million m^3/year in the 1980s, 4 million m^3/year in the 1990s), and pay much attention to develop the processing of recycled fiber as well as strengthen the whole tree utilization. The latter means to promote the development of the forest products industry.

Developing Survey of Forest Product Industry

Table 1. Products and yield of forest product industry

item of products	Amount of enterprise	yield(million m^3/year)
Plywood	515	2.0
Fiberboard	391	1.68
(including MDF)	17	0.31
Particleboard	216	1.42
total	1122	5.10

The yield of chip is 0.6 million m^3/year . The development of MDF (Middle Density Fiberboard), particleboard and chip production is fast. The total yield of wood-based composite will reach to 8-10 million

m³/year and the yield of chip will reach 5 million m³/year in the 2000s. The production of composite from Non-Wood materials (bamboo, cotton stalk and wheat stalk etc.) increase steadily. The total yield of Non-Wood based composite is about 0.3 million m³/year now, and it will reach to 1.0 million m³/year in the 2000s. The equipment of the production line of composite are partly introduced from foreign country such as Germany, Sweden, United states etc. and partly are domestically manufactured.

Recycled Fiber Processing

In China we are facing increasing restriction on harvesting of forest and to meet growing demand for timber and wood-based products while still meeting our sustainability goal. It is found that the recycling of wood fiber provides an opportunity to meet both objects: providing the raw material used in pulp-paper industry and forest products industry and conservation of forest resources. Before describing the processing of recycled fiber, we should introduce the pulp-paper industry in China.

The general situation of pulp-paper industry in china

Although the pulp-paper industry keep up a steadily increasing tendency but still can't meet the needs of economic development. So far China still is a big imported country of pulp and paper. In 1994, the paper and paper board imported were about 3181 tons pulp imported 710 tons and waste paper 710 tons. The total yield of paper and paperboard will reach 2700 tons/year in the 2000s.

Table 2. Total yield and increasing rate of paper and paper board

Year	Total Yield(ton)	increasing rate(%)
1986	9990	+9.7
1987	11410	+14.2
1988	12700	+11.3
1989	3333	+5.0
1990	13.718	+2.9
1991	14787	+7.8
1992	17251	+16.7
1993	18200	+5.5
1994	20000	+10.0

The characteristics of pulp-paper industry are as follows:

1. The structure of raw material is unreasonable, mainly non-wood fiber pulp (grass, bamboo, hemp, reed, rag etc.), less wood pulp. The proportion of wood pulp were decreased year by year, which was 24.8% in 1980, 22.6% in 1985, and 14.6% in 1990.

2. The scale of enterprise is not big. Many small fac-

ories haven't soda recovery system and have serious pollution problems. Recently Chinese government decided that the small factory (annual yield of paper 5 tons/year) must be closed and the rate of soda recovery must be reached 80-90% in the middle and big enterprises (M-BE).

Table 3. Developing trend of the scale of enterprises

	1990	1995	2000
total number of papermaking enterprises	5360	5000	4500
including: the number of * M-BE	242	300	400
Proportion of M Be in total number %	4.5	6	9
proportion of M-BE in the total yield(%)	37	45	55

*M-BE: M; Mid enterprises, it's Capacity > 10 tons/year

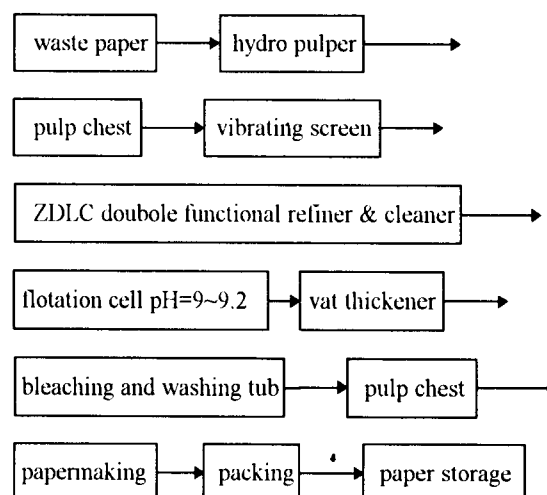
B: big enterprises, it's capacity>30tons/year

Table 4. The governing target of environmental protection

	1990	1995	2000
Annual Amount of Soda Recover(ton)	340	500	700
Recovery rate of Annual soda consume(%)	30	35	40
the standard of draining waste water		B. E.	M-BE

The recovery paper technology

The recovery rate of waste paper is about 25% in China now. The recovery rate is low and ONP must be imported from abroad every year. The factories of the recovered paper technology were often distributed in ports or suburb of urban. There are two kinds of processing of recycled fibers. One is small and simple processing, with capacity 10 tons/d. A series of equipment of production line were manufactured by ourselves. The typical processing flow sheet is shown in Figure 1. There are about 600 small factories using above mentioned processing in China.



*: using cylinder vat machine, it's speed 300 m/min.

Fig 1. The processing flow sheet of small factory of regeneration of waste paper.

The ink and contaminants were isolated from pulp of waste paper using flotation deinking method.

The other is large and advanced processing, with capacity about 100 tons/d. A series of equipment of production line were introduced from foreign country such as Japan, Sweden. The recovered paper technology take less energy and drain less waste water and generate more sludge in comparison with making paper from virgin fiber. As the recycled fiber is weaker than virgin fiber, the recycled paper can be substituted low grade paper products for virgin wood material.

On recycling of wood-based panels

Recycled wood-based composite products are other aspects of processing of recycled fibers. The processing involves breaking waste wood or wood-based panel into flakes or fibers and reassembling them into new forms with the aid of an adhesive. Since the raw materials are

devived from waste, many forms and sources of waste wood or wood-based composite will likely pose special processing considerations, particular to remove the contaminants from waste wood or wood-based composites.

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